

SYNOPSIS OF TELEMEDICINE RESEARCH STUDIES

Jim Grigsby, Ph.D., Elliot J. Sandberg, M.D., Margaret M. Kaehny, B.A., Andrew M Kramer, M.D., Robert E. Schlenker, Ph.D. Peter W. Shaughnessy, Ph.D. “Analysis of Expansion of Access to Care Through Use of Telemedicine and Mobile Health Services” Report 2: Case Studies and Current Status of Telemedicine” A Report Prepared by the Center for Health Policy Research for the Health Care Financing Administration, May 1994.

The Center for Health Policy Research, under contract with the HCFA, performed an evaluation of the status of telemedicine. The primary focus of this evaluation was to determine how telemedicine was being used and to obtain additional information on whether telemedicine is safe and effective. As part of the evaluation, case studies were conducted between November 1993 and March 1994. The programs selected varied on several parameters including technological sophistication, administrative structure, involvement in research, degree of isolation, range of applications, source of funding and length of operation. The goal in the selection of these programs was to provide a cross sectional representation of telemedicine activity in North America.

The following 8 telemedicine programs were selected for site visits: Medical College of Georgia (Augusta, Georgia); University of Kansas (Kansas City, Kansas); Eastern Montana Telemedicine Project (Billings Montana); Oregon Health Sciences University (Portland, Oregon); Memorial University of Newfoundland Health Sciences center (St. John’s Newfoundland); Tripler Army Medical Center (Oahu Hawaii); NASA Johnson Space Center (Houston Texas); East Carolina University (Greenville, North Carolina). Additionally, telephonic interviews were conducted with the following 5 telemedicine programs: Rodeo Net (Lagrande Oregon); Robert C. Byrd Health Sciences Center, West Virginia University (Morgantown West Virginia); University of Oklahoma Health Sciences Center (Oklahoma City, Oklahoma); Stanford University (Palo Alto, California); Texas Tech University Health Sciences Center (Lubbock Texas).

Review of the case studies indicate that applications for telemedicine span across virtually all medical specialties and levels of care with the top specialties including neurology, cardiology, dermatology and mental health. Specific applications range from teleradiology and ECG transmissions to virtual reality devices such as the “data glove” which is designed to simulate tactile sensation. Although the spectrum of telemedicine covers a broad range of clinical applications, at the time of the evaluation, total volume of telemedicine was quite low. Data indicates that many mature and technologically sophisticated programs reported as few as 2-5 contacts per week. Additionally, the majority of the first wave of telemedicine programs were located in academic medical centers with education as a major portion of the telecommunications system.

In most cases a telemedicine program consists of a tertiary care hub with a few remote sites rather than a interconnected system or “network”. Typical program equipment includes: interactive

compressed video, 1 and 3 chip charge coupled device cameras, document camera, electronic stethoscope, fax machine and CODEC for translating analog to digital signals. Communications mediums ranged from twisted pair wire to satellite capabilities. Most programs included in the case studies had access to full T1 band width while all programs used a minimum band width of 1/4 T1 for telemedicine transmission.

Review of the telemedicine case studies strongly suggests that telemedicine is not ready for a blanket endorsement as a safe and effective method of health care delivery. Site visits / interviews indicate that, while many radiographs can be adequately viewed via telecommunications, problems have been raised concerning the viewing of chest and bone films when digitized.

Additionally, clinical effectiveness of telemedicine consultations has not been fully demonstrated. Case studies suggests uncertainty in the safety and effectiveness of telemedicine as a substitute for a face to face encounter for nearly every specialty. For instance, cardiologists have reported quality concerns regarding the use of the electronic stethoscope stating that they had difficulty hearing rales. Some dermatologists expressed concern with their ability to view skin lesions stating that resolution, color, level and type of illumination may all affect diagnostic accuracy; ophthalmologist have found the ophthalmoscope providing poor quality images. Problems with mental health visits practitioners have expressed uncertainty regarding the quality of rapport established with the client and the inability to assess non-verbal behaviors.

Further review of the case studies indicate uncertainty regarding whether telemedicine provides cost-effective access to medical care. Many programs cite reduced physician and patient travel, and earlier access to care as potential cost savers. While these may be savings in their own right, they could be offset by increased cost to other components of the system such as capital and line charges. As such, the impact on providers, payers, patients and the health care delivery system as a whole remains ambiguous, at least until telemedicine utilization increases. Legitimate concern for the potential of over-utilization, fraud and abuse must also be recognized. Further, it is not clear whether telemedicine will be used in addition too or as a substitute for conventional medical services delivery.

Conclusions from the case studies strongly recommend a thorough assessment of cost; utilization; safety and effectiveness; and cost effectiveness before expanding coverage and payment of telemedicine applications. As this dynamic and complex technology may be slow to become part of the mainstream in health care delivery research endeavors may take several years.

**A. Allen, M.D., M. Scarbrough. 1996. "Third Annual Program Review."
Telemedicine Today July/August 1996**

This article reports on a survey evaluating telemedicine programs actively conducting teleconsultations in 1995. Data collection and resulting tables (survey data attached, see appendix C) focused on teleconsultations only and is not intended to reflect the general state of telemedicine activity. Although the data gathered from this survey focuses exclusively on consultations performed via telecommunications, we found this research to be relevant because it presents snapshot data on a possible next step in the coverage of telemedicine... patient to physician teleconsultations. (Currently, Medicare allows coverage for medical services delivered via telecommunications that do not require a face to face, "hands on," encounter e.g., teleradiology).

For purposes of the survey, teleconsultations were defined as patient to physician consultations using any type of interactive video technology. The survey identified 40 telemedicine programs that performed interactive video physician to patient consults in 1995. Additionally, another 10 programs used interactive video for physician to physician consultations. It is believed that the networks included in the survey provide a strong representation of teleconsultation activity in North America for 1995.

The survey data provides a broad spectrum of data elements regarding utilization, specialty applications, infrastructure, funding sources, program maturity, and organizational structure. Overall, 1995 survey data indicates large increases over 1994 activity in many categories including: the number of telemedicine programs performing patient to physician teleconsultations; total sites served; and total number of teleconsultations performed in North America. For instance, in 1995 the number of teleconsultations performed nationally grew from the previous year from 2,110 to 6,267 (almost a 200% increase) while the number of networks increased 67% from 24 (serving 99 sites) to 40 with total number of sites increasing 5 times to 498 sites. The number of teleconsultations per site actually decreased from 21.3 in 1994 to 12.6 in 1995. This occurrence may well be explained by the fact that many of the sites were added near the end of the year, thus not allowing volume to accrue.

Although aggregate data shows a substantial increase in the number of telemedicine programs and total teleconsultations performed in 1995, the volume of teleconsultations varies greatly from program to program. For instance, the McKennan Telemed Project in Sioux Falls, SD performed only 3 teleconsultations while the TeleMed Program in Galveston Texas performed 1,852. Data also illustrates that steady utilization is concentrated among only a few telemedicine networks as the top 10 networks, as defined by volume, accounted for nearly 80% of patient to physician teleconsultations in 1995. It should be strongly noted that the top 3 networks, provide teleconsultations exclusively to prison populations and accounted for nearly 50% of total patient to physician teleconsultations in 1995.

Rounding out the top 3 networks includes: HealthNet (Texas Tech University) in Lubbock Texas with 731 and Arapahoe County Adult Detention Center in Denver, Colorado with 400 teleconsultations.

According to 1995 survey data (see appendix E), the average telemedicine network consists of: 2 hub sites and 11 distant (spoke) sites (median of 1 hub and 5 spokes sites); performed 157 consults (12.6 consults per site) with an average duration of 33.4 minutes per consultation. Compressed digital technology using 1/4 T1 band width (which translates to a transmission rate of 384 thousand bits per second) appears to be the minimum standard for most teleconsultations. Data also indicates that mental health is the most frequently utilized specialty consultation followed by dermatology and cardiology.

The survey did not provide any data regarding the cost per consultation. Calculating the cost per consultation is a complex undertaking that involves the consideration of many factors. These factors include but are not limited to: medical practitioner services; cost of telemedicine infrastructure; transmission cost; availability of telecommunications infrastructure; depreciation and amortization assumptions; administration; percentage of time attributed to teleconsultations as opposed to other video conferences (e.g., education); and any projected saving resulting from reduced travel. One thing is clear however, that expensive equipment combined with very low volume, equates to a very high cost per teleconsultation for many telemedicine programs.

Andrea Hassol, 1996. "Rural Applications of Telemedicine." Report Prepared by Abt Associates Inc. for the Office of Rural Health Policy, Health Resources and Services Administration.

This research report was conducted to evaluate the use of telemedicine among rural hospitals by Abt Associates Inc. and the University of Colorado for the Office of Rural Health Policy (See Appendix D). The focus of this evaluation was to determine the current status of rural telemedicine and to develop protocols for future rural telemedicine research. The study design included the following 3 phases: (1) a nationally conducted preliminary survey intended to identify rural hospitals with telemedicine programs; (2) an extensive follow up survey to collect data regarding how telemedicine was currently being used; and (3) a comprehensive site visit at 4 rural telemedicine programs to augment the survey data. Data collection for this project spanned from mid 1995 through early 1996.

The initial screening survey along with additional research efforts identified 499 rural hospitals using telemedicine. Among these hospitals, 340 did exclusively teleradiology and 159 performed telemedicine applications beyond teleradiology e.g., teleconsultations. About half of the programs performing teleconsultations also did teleradiology applications. The follow up survey collected data regarding utilization, size of programs, types of medical specialties performed, equipment and transmissions medium, funding, infrastructure and operating cost, and the overall acceptance of the use of telecommunications as a method for medical service delivery. Selection of telemedicine programs for site visits varied according to maturity of the program, type of transmission and equipment, administrative structure and clinical applications. Programs were avoided that provided telemedicine to only prison populations, were limited to teleradiology, and have been previously studied. The following programs were selected as case studies: The Rural Health Alliance/Allina program in Minnesota; The University of North Carolina at Chapel Hill; Deaconess/Billings Montana; and the University of Kentucky.

A summary of the major findings from the follow up survey and site visits is outlined below:

- o On average, telemedicine programs within rural hospitals have been in operation between 1 and 2 years. The typical program consists of 4 distant sites, 2 hub sites and 4 sites functioning as both a hub and spoke site.
- o The survey found that teleradiology is the most common telemedicine application. Over 84% of the rural hospital doing telemedicine use the system to deliver some type of radiology service. The top 5 teleradiology applications include: CT scans; radiographs; nuclear medicine; MRI and excretory urography.
- o The utilization of telemedicine is quite low for most rural telemedicine programs. For instance, the mean number of total sessions for all uses (including non clinical) was 24

with a median of 11. However, study data indicates a strong association between age of a telemedicine program and utilization. That is, as programs gain experience with using telecommunications to delivery health care, telemedicine utilization increases.

- o Despite low volume, telemedicine was used to delivery a broad range of medical specialties. The top specialty consultations included: dermatology; cardiology; neurology orthopedics, and oncology. Education and administration are a significant component of many telecommunication systems as well.
- o The telemedicine equipment and telecommunications infrastructure was noted as being large, sophisticated, and expanding rapidly. Survey data illustrates that copper phone lines and fiber optics transmitted at T1 bandwidth are the most frequently used telecommunications medium. On the other hand, satellite and microwave technologies were used by less than 10 percent of the programs. The most frequently used telemedicine equipment includes: a document camera; 1 and 3 chip CCD camera; electronic stethoscope; x-ray scanner; otoscope and dermascope.
- o Funding for rural telemedicine programs most often is provided by 3 major sources: (1) hospital support including direct payment of expenses; Federal funding; and vender and telephone company assistance. Very few telemedicine programs are receiving payments from third party insurers.
- o The average cost of telemedicine infrastructure e.g.,equipment used to capture and view the patients condition, ranged from \$134,378 for distant sites to \$287,503 for hub sites. Annual transmission costs ranged from an average of \$18,573 for distant sites and \$80,068 for hub sites. These data do not include any cost associated with the installation of new telecommunications infrastructure e.g., switches and new lines .
- o The median cost per teleconsultation for a hub site was \$1,181 and \$476 for a spoke site. These cost findings exclude payments make to clinicians. Abt Associates Inc. attribute such findings to high infrastructure and operating costs and low utilization.
- o Review of site visit data suggests that telemedicine programs are initiated before a formal assessment of medical need is conducted. Program applications appear to be selected based on the specialty of a strong advocate physician (referred to as a “clinical champion”) rather than to meet an identified clinical need.
- o Generally, patient acceptance of telemedicine is favorable, while reactions from clinicians have been mixed.
- o The lack of reimbursement, difficulties with scheduling and time commitment, absence of large clinical trials, and clinical standards were listed as barriers to further development of telemedicine.

- o Upon review of survey and site visit data, the report recommends that a consistent cross cutting data collection approach to study clinical efficacy and evaluate cost effectiveness is greatly needed. However, with regards to cost effectiveness, the evolution of telemedicine may not be far enough along to conduct such evaluations.